Plant Sciences Research

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Effect of Foliar Spraying of Growth Regulators and Biostimulants on Growth, Physiology and Yield of Leafy Coriander (*Coriandrum sativum* L.)

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Key words: *Coriandrum sativum* L., growth regulators, biostimulants, yield, growth parameters

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Page No.: 28-34
Volume: 12, Issue 3, 2020
ISSN: 1995-476x
Plant Sciences Research

Abstract: An experiment was conducted at Tamil Nadu Agricultural University, Coimbatore, India during 2015 with an objective of studying the effect of growth regulators and biostimulants on growth, physiology and yield in leafy coriander (*Coriandrum sativum* L.). The experiment was laid out in a Factorial Randomized Block Design (FRBD) with sixteen treatments replicated thrice. The results revealed that the growth parameters like plant height (19.50 and 30.60 cm), number of primary branches (5.90 and 12.83), number of leaves (20.12 and 43.82) and physiological parameters like total chlorophyll content (2.350 and 2.470 mg g^{-1}), leaf area (32.73 and 52.15 cm^2), leaf area index (0.073 and 0.156) and leaf area duration (0.47 and 1.15 days) at 35 and 45th Days After Sowing (DAS) were recorded highest in the treatment Combinations of Variety (CO CR-4) + Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing. The same combination recorded the highest herbage yield (3751 kg ha^{-1}) when compared to other treatments.

INTRODUCTION

Coriander is a delicate annual aromatic herb known as cilantro, Chinese parsely, Mexican parsely, Japanese parsely and is a member of family Apiaceae. It is native of Mediterranean region and is one of the earliest known spices by mankind, grown for its leaves, seeds, essential oil and oleoresin. India is a major producer and exporter of coriander seeds. The annual production of coriander in India is estimated to be 5.03 lakhs tonnes from an area of 5.30 lakhs hectares (Anonymous, 2013).

The productivity of coriander in India is low (519 kg ha^{-1}) (Saini, 2003). Indian coriander is considered to be poor in essential oil content (0.04- 0.08%) as compared to European types (1.4-1.7%). Coriander is mostly grown by small farmers and marginal farmers following a traditional cultivation practices and hence the yield obtained is low. The average productivity of coriander grains in Tamil Nadu is 700 kg ha^{-1} under rainfed conditions. The productivity of leaf crop is 1000-1200 kg ha^{-1}. The low level of productivity is attributed to many factors viz., poor yielding native strains, varying soil types, poor nutrition, pest and diseases etc. Further since they are grown in dry areas, prolonged drought situation and eratic monsoon limits their timely sowing and establishment. Technological interventions are required on the use of growth hormones, biostimulants etc to increase the value of the produce apart from increasing the yield levels[3]. Plant growth regulators and biostimulants are biologically active

material which influence the photosynthesis, cell division, cell elongation and helps the uptake of nutrients to the plants. Several plant growth promoting and biostimulant substances have been commercialized and are available in the market. They are used to modify the growth and development, to control the proper balance in source and sink essential for increasing yield of crops[4].

Coriander is a short duration crop which comes to maturity in 30-45 days for a leafy type. Within this period, it is imperative for application of growth hormones, biostimulants at periodical intervals, apart from soil application of nutrients to supply the required nutrients. Research has proved that through précised application of nutrients at desired stages, the productivity could be improved two to three times the present yield. With the view of improving the productivity in leafy coriander, the application of growth substances viz., NAA (1-Napthalene Acetic Acid), triacontanol and biostimulants (Panchagavya and humic acid) were tried to achieve the effect of growth regulators and biostimulants on growth, physiology and yield of leafy type.

MATERIALS AND METHODS

The experiment was conducted during Rabi season (July-August) at Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore, India which is located at 11°02 N latitude, 77° 03" E longitude and at an altitude of 426.76 M above MSL.

Seeds of coriander variety CO CR-4 and culture CS 18 were sown in lines adopting a spacing of 30×15 cm. Plants were thinned at 30 DAS (days after sowing) retaining 10 cm space between plants. Recommended package of practices were followed uniformly to all the plots[5].

The experiment was laid out in a Factorial Randomized Block Design (FRBD) with sixteen treatments replicated thrice. The treatment details are given in Table 1. The growth regulators and biostimulants were treated as foliar spray and sprayed uniformly to all the plants with the help of a hand sprayer during morning hours. The growth regulators like NAA (1-Napthalene Acetic Acid) were applied at 50 ppm (parts per million) concentration, Triacontanol (vipul) was applied by adding 1 mL in 1 L of water and humic acid were applied at the concentration of 0.1%. The biostimulant namely Panchagavya (combination of five products from the cow which includes cow dung, cow's urine, milk, curd and ghee) was applied at the concentration of 3%. The treatment was given at 20, 30 and 40 DAS with an interval of 10 days.

The observations like plant height, number of primary branches, number of leaves and physiological parameters like total chlorophyll content, leaf area, leaf area index, leaf area duration were recorded. Fully opened leaf was used for recording leaf measurements and physiological and biochemical analyses[6]. The height of the plant was measured from the ground level to the tip of the growing point of the main stem. The number of leaves and primary branches per plant was recorded at 35 and 45 DAS.

Table 1: Treatment details

Sub factor; sixteen/growth regulators/biostimulants	Dosage	Time of application
NAA	50 (ppm)	20 DAS
NAA	50 (ppm)	20 and 30 DAS
NAA	50 (ppm)	20, 30 and 40 DAS
Triacontanol	0.5 (mL L^{-1})	20 DAS
Triacontanol	0.5 (mL L^{-1})	20 and 30 DAS
Triacontanol	0.5 (mL L^{-1})	20, 30 and 40 DAS
Triacontanol	1 (mL L^{-1})	20 DAS
Triacontanol	1 (mL L^{-1})	20 and 30 DAS
Triacontanol	1 (mL L^{-1})	20, 30 and 40 DAS
Humic acid	0.1 (%)	20 DAS
Humic acid	0.1 (%)	20 and 30 DAS
Humic acid	0.1 (%)	20, 30 and 40 DAS
Panchagavya	3 (%)	20 DAS
Panchagavya	3 (%)	20 and 30 DAS
Panchagavya	3 (%)	20, 30 and 40 DAS
Control-water spray		

NAA = 1- Napthalene Acetic Acid/ppm = parts per million/DAS = days after sowing, main factor: two V_1, V_2, Variety/culture, variety CO CR-4, CS 18

For chlorophyll analysis, the leaves were collected at 35 and 45 days after sowing, weighed and macerated in a homogenizer with 80% acetone. The extract was centrifuged at 4000 rpm for 15 min. The supernatant was collected and made up to a known volume. The absorbance of extract was read in a spectronic 20 photoelectric colorimeter at 645 and 663 nm[7]. The leaf area of the leaves was recorded by feeding the leaves into the photosensitive, automatic portable leaf area meter (Model LI-3000). The leaf area index was computed by adopting the formula suggested by Williams. The leaf area duration was estimated on 25-35 and 35-45 days after sowing by adopting the formula suggested by Power *et al*.[8].

RESULTS AND DISCUSSION

In this study, the morphological characters were significantly influenced by foliar application of growth regulators and biostimulants in different combinations at different stages of plant growth. Among the interactions, the treatment combination of Variety (CO CR-4) +Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing exhibited the tallest plants (19.50 and 30.60 cm) (Table 2). This might be due to enhanced nutrient uptake and increased cell division[9].

The treatment interaction, variety (CO CR-4) + Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing registered the highest number of primary branches per plant (5.90 and 12.83) and more number of leaves per

Table 2: Effect of varieties and growth promoting substances on plant height (cm) in coriander

	35 DAS			45 DAS		
Treatments	V_1 (CO CR-4)	V_2 (CS 18)	Mean	V_1 (CO CR-4)	V_2 (CS18)	Mean
T_1	13.90	12.30	13.10	20.37	18.60	19.49
T_2	14.80	13.50	14.15	21.67	19.75	20.71
T_3	17.90	15.53	16.72	25.17	23.47	24.32
T_4	14.10	12.30	13.20	19.17	18.78	18.98
T_5	15.20	13.40	14.30	20.00	19.14	19.57
T_6	15.70	14.20	14.95	21.08	21.35	21.22
T_7	15.00	13.20	14.10	18.63	18.80	18.72
T_8	15.90	14.10	15.00	21.84	20.74	21.29
T_9	19.50	17.50	18.50	30.60	26.49	28.55
T_{10}	15.40	12.40	13.90	19.79	19.56	19.68
T_{11}	15.90	13.20	14.55	21.73	20.94	21.34
T_{12}	16.60	15.91	16.26	22.50	21.33	21.92
T_{13}	14.00	12.41	13.21	20.70	19.43	20.07
T_{14}	15.20	13.80	14.50	21.70	21.17	21.44
T_{15}	16.20	14.50	15.35	22.92	21.63	22.28
T_{16}	12.10	10.33	11.22	17.53	16.83	17.18
Mean	15.46	13.66	14.56	21.59	20.50	21.04
	SED	CD (0.05)	-	SED	CD (0.05)	-
V	0.018	0.036	-	0.144	0.288	-
T	0.051	0.101	-	0.409	0.817	-
VT	0.072	0.143	-	0.578	1.155	-

Table 3: Effect of varieties and growth promoting substances on number of primary branches per plant in coriander

	35 DAS			45 DAS		
Treatments	V_1 (CO CR-4)	V_2 (CS 18)	Mean	V_1 (CO CR-4)	V_2 (CS18)	Mean
T_1	2.30	2.19	2.25	7.200	6.450	6.830
T_2	2.50	2.43	2.47	8.070	7.150	7.610
T_3	4.10	3.02	3.56	11.30	9.100	10.20
T_4	2.30	2.28	2.29	8.280	7.250	7.770
T_5	2.80	2.70	2.75	9.670	8.500	9.090
T_6	3.30	2.58	2.94	10.93	9.200	10.07
T_7	2.10	2.08	2.09	7.730	7.100	7.420
T_8	3.10	2.76	2.93	9.200	7.900	8.550
T_9	5.90	4.65	5.28	12.83	10.50	11.67
T_{10}	2.10	2.00	2.05	9.060	7.260	8.160
T_{11}	2.60	2.30	2.45	9.870	7.500	8.690
T_{12}	3.20	2.80	3.00	10.40	8.200	9.300
T_{13}	2.10	1.86	1.98	8.730	7.300	8.020
T_{14}	2.71	2.20	2.46	9.730	8.250	8.990
T_{15}	2.90	2.40	2.65	10.77	8.900	9.840
T_{16}	1.91	1.60	1.76	7.010	6.430	6.720
Mean	2.87	2.49	2.68	9.420	7.440	8.430
	SED	CD (0.05)	-	SED	CD (0.05)	-
V	0.062	0.125	-	0.014	0.028	-
T	0.177	0.353	-	0.040	0.080	-
VT	0.249	0.499	-	0.059	0.114	-

plant (20.12 and 43.82) followed by the combination Variety (CO CR- 4)+NAA 50 ppm at 20, 30 and 40 days after sowing with 4.10, 11.30 branches and 18.59 and 39.63 leaves per plant. The lowest number of primary branches per plant (1.60 and 6.43) was recorded in the treatment combination CS 18+Control at 35 and 45 DAS, respectively (Table 3 and 4).

The increase in number of branches was slow at initial stage but picking up fast till the harvest stage of the crop. This might be due to increased uptake of nutrients and availability for the plant growth. The easy transfer of nutrients to plants would have been enhanced by foliar application of triacontanol which would have promoted protein synthesis from reserved carbohydrates leading to the production of more carbohydrates thereby leading to the production of more number of primary branches and leaves[10].

In the interaction, Variety (CO CR-4)+Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing expressed highest total chlorophyll content (2.350 and 2.470 mg g^{-1}) at 35 and 45 DAS respectively (Table 5). This was followed by variety (CO CR-4)+NAA 50 ppm at 20, 30

Table 4: Effect of varieties and growth promoting substances on number of leaves per plant in coriander

	35 DAS			45 DAS		
Treatments	V_1 (CO CR-4)	V_2 (CS 18)	Mean	V_1 (CO CR-4)	V_2 (CS18)	Mean
T_1	16.35	12.14	14.25	22.08	19.02	20.55
T_2	17.35	13.98	15.67	26.67	23.98	25.33
T_3	18.59	16.80	17.69	39.63	36.00	37.82
T_4	15.41	12.10	13.75	22.83	22.86	22.85
T_5	16.50	13.50	15.00	25.40	24.35	24.88
T_6	17.63	15.25	16.44	30.25	27.91	29.08
T_7	13.26	11.85	12.55	22.26	20.16	21.21
T_8	15.16	13.24	14.20	25.84	24.65	25.25
T_9	20.12	17.18	18.65	43.82	38.44	41.13
T_{10}	13.90	12.10	13.00	22.36	21.85	22.11
T_{11}	14.50	13.75	14.13	26.64	24.19	25.42
T_{12}	15.85	13.85	14.85	28.80	27.99	28.40
T_{13}	14.20	12.20	13.20	21.83	19.20	20.52
T_{14}	14.90	13.15	14.03	24.67	22.18	23.43
T_{15}	15.50	13.95	14.72	26.18	25.40	25.79
T_{16}	12.85	10.98	11.92	19.00	17.20	18.10
Mean	15.75	13.50	14.63	26.77	24.71	25.74
	SED	CD (0.05)	-	SED	CD (0.05)	-
V	0.049	0.099	-	0.187	0.374	-
T	0.141	0.281	-	0.529	1.059	-
VT	0.199	0.397	-	0.749	1.497	-

Table 5: Effect of varieties and growth substances on total chlorophyll content (mg g^{-1}) leaves in coriander

	35 DAS			45 DAS		
Treatments	V_1 (CO CR-4)	V_2 (CS 18)	Mean	V_1 (CO CR-4)	V_2 (CS18)	Mean
T_1	2.260	2.090	2.175	2.280	2.110	2.195
T_2	2.220	2.120	2.170	2.235	2.140	2.188
T_3	2.290	2.240	2.265	2.330	2.290	2.310
T_4	2.180	2.060	2.120	2.200	2.100	2.150
T_5	2.210	2.103	2.157	2.250	2.125	2.188
T_6	2.290	2.114	2.202	2.300	2.150	2.225
T_7	2.190	2.065	2.128	2.220	2.125	2.173
T_8	2.250	2.115	2.183	2.320	2.160	2.240
T_9	2.350	2.270	2.310	2.470	2.310	2.390
T_{10}	2.115	2.050	2.083	2.145	2.090	2.118
T_{11}	2.160	2.090	2.125	2.190	2.116	2.153
T_{12}	2.220	2.114	2.167	2.240	2.180	2.210
T_{13}	2.168	2.085	2.127	2.190	2.115	2.153
T_{14}	2.213	2.135	2.174	2.250	2.165	2.208
T_{15}	2.250	2.190	2.220	2.315	2.225	2.270
T_{16}	2.048	1.997	2.023	2.110	2.030	2.070
Mean	2.213	2.115	2.164	2.253	2.152	2.202
	SED	CD (0.05)	-	SED	CD (0.05)	-
V	0.018	0.037	-	0.021	0.042	-
T	0.052	0.104	-	0.060	0.121	-
VT	0.074	0.148	-	0.086	0.171	-

and 40 days after sowing which registered 2.290 and 2.330 mg g^{-1}. The lowest total chlorophyll content of 1.997 and 2.030 mg g^{-1} was recorded in the treatment combination CS 18+Control at all stages. Better availability and uptake of nutrients in soil and effective conversion of these nutrients, such as Fe, Mg and N at the site of photosynthesis would have resulted in high total chlorophyll content in leaves[11].

In plants, the photosynthetic efficiency is determined by the leaf area produced by the crop. Among the combinations, the treatment combination, variety (CO CR-4)+Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing registered the highest leaf area (9.16, 32.73 and 52.15 cm^2) and leaf area index (0.020, 0.073 and 0.156) at all stages 25, 35 and 45 DAS, respectively (Table 6 and 7). The treatment combination CS 18+Control expressed the lowest leaf area of 5.00, 11.01 and 18.80 cm^2 at all stages. The increase in leaf area has accounted for enhanced the leaf area index and leaf area duration of the crop at all the stage of the crop growth[12].

Among the interaction effect between the varieties and foliar treatments, Variety (CO CR- 4) +Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing registered the highest leaf area duration of 0.47 and 1.15 days. The lowest value was recorded in CS 18+Control with 0.17 and 0.32 days at 25-35 DAS and 35-45 DAS (Table 8).

Table 6: Effect of varieties and growth substances on total leaf area (cm^2) in coriander

	25 DAS			35 DAS			45 DAS		
Treatments	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	6.200	5.700	5.950	12.23	14.38	12.23	21.10	22.05	23.00
T_2	6.760	5.950	6.360	14.15	15.68	14.15	24.50	25.68	26.86
T_3	8.130	7.110	7.620	22.14	25.10	22.14	36.40	38.65	40.90
T_4	6.300	5.600	5.950	12.60	14.78	12.60	22.14	23.25	24.36
T_5	6.370	5.900	6.140	14.50	16.33	14.50	24.25	25.38	26.50
T_6	7.010	6.150	6.580	17.17	18.72	17.17	28.63	29.37	30.10
T_7	6.250	5.600	5.930	13.19	15.67	13.19	21.50	23.00	24.50
T_8	6.940	5.950	6.450	16.75	18.83	16.75	26.31	27.96	29.60
T_9	9.160	8.140	8.650	27.05	29.89	27.05	38.20	45.18	52.15
T_{10}	6.300	5.630	5.970	14.50	16.94	14.50	22.19	23.75	25.30
T_{11}	6.900	5.960	6.430	16.95	19.30	16.95	24.30	26.70	29.10
T_{12}	7.200	6.100	6.650	20.20	22.26	20.20	26.26	28.20	30.14
T_{13}	6.370	5.550	5.960	13.90	15.63	13.90	21.90	23.35	24.80
T_{14}	6.630	5.760	6.200	16.20	18.08	16.20	26.35	27.48	28.60
T_{15}	7.020	6.300	6.660	19.15	20.85	19.15	28.20	30.25	32.30
T_{16}	5.770	5.000	5.390	11.01	12.05	11.01	18.80	19.65	20.50
Mean	6.830	6.030	6.430	16.36	18.40	16.36	25.69	27.49	29.29
	SED	CD (0.05)	-	SED	CD (0.05)	-	SED	CD (0.05)	-
V	0.021	0.043	-	0.073	0.146	-	0.079	0.158	-
T	0.061	0.122	-	0.206	0.413	-	0.223	0.447	-
VT	0.086	0.172	-	0.292	0.584	-	0.316	0.632	-

Table 7: Effect of varieties and growth substances on leaf area index (LAI) in coriander

	25 DAS			35 DAS			45 DAS		
Treatments	V_1	V_2	Mean	V_1	V_2	Mean	V_1	V_2	Mean
T_1	0.014	0.013	0.014	0.036	0.027	0.032	0.051	0.046	0.049
T_2	0.015	0.013	0.014	0.038	0.031	0.035	0.060	0.054	0.057
T_3	0.018	0.016	0.017	0.062	0.049	0.056	0.091	0.081	0.086
T_4	0.014	0.012	0.013	0.037	0.028	0.033	0.054	0.049	0.052
T_5	0.014	0.013	0.014	0.040	0.032	0.036	0.059	0.054	0.057
T_6	0.016	0.014	0.015	0.045	0.038	0.042	0.067	0.063	0.065
T_7	0.013	0.012	0.013	0.040	0.029	0.035	0.054	0.048	0.051
T_8	0.016	0.013	0.015	0.046	0.037	0.042	0.066	0.058	0.062
T_9	0.020	0.018	0.019	0.073	0.060	0.067	0.156	0.085	0.121
T_{10}	0.014	0.013	0.014	0.043	0.032	0.038	0.056	0.049	0.053
T_{11}	0.015	0.013	0.014	0.048	0.037	0.043	0.065	0.054	0.060
T_{12}	0.016	0.014	0.015	0.054	0.044	0.049	0.067	0.058	0.063
T_{13}	0.014	0.012	0.013	0.039	0.031	0.035	0.055	0.049	0.052
T_{14}	0.015	0.013	0.014	0.044	0.036	0.040	0.064	0.059	0.062
T_{15}	0.016	0.014	0.015	0.050	0.043	0.047	0.072	0.063	0.068
T_{16}	0.013	0.011	0.012	0.029	0.022	0.026	0.046	0.042	0.044
Mean	0.015	0.013		0.045	0.036		0.068	0.057	
	SED	CD (0.05)	-	SED	CD (0.05)	-	SED	CD (0.05)	-
V	0.00007	0.00014	-	0.00011	0.00023	-	0.00017	0.00034	-
T	0.00019	0.00039	-	0.00032	0.00065	-	0.00049	0.00097	-
VT	0.00027	0.00055	-	0.00046	0.00091	-	0.00069	0.00138	-

Table 8: Effect of varieties and growth substances on leaf area duration (LAD) (days) in coriander

	25-35 DAS (days)			35-45 DAS (days)		
Treatments	V_1 (CO CR-4)	V_2 (CS 18)	Mean	V_1 (CO CR-4)	V_2 (CS18)	Mean
T_1	0.25	0.20	0.23	0.44	0.37	0.41
T_2	0.27	0.22	0.25	0.49	0.43	0.46
T_3	0.40	0.33	0.37	0.77	0.65	0.71
T_4	0.26	0.20	0.23	0.46	0.38	0.42
T_5	0.27	0.23	0.25	0.50	0.43	0.47
T_6	0.31	0.26	0.29	0.56	0.51	0.54
T_7	0.27	0.21	0.24	0.47	0.38	0.43
T_8	0.31	0.25	0.28	0.56	0.48	0.52
T_9	0.47	0.36	0.42	1.15	0.73	0.94
T_{10}	0.29	0.23	0.26	0.50	0.41	0.46
T_{11}	0.32	0.25	0.29	0.57	0.46	0.52
T_{12}	0.35	0.29	0.32	0.61	0.51	0.56

Table 8: Continue

Treatments	25-35 DAS (days)			35-45 DAS (days)		
	V_1 (CO CR-4)	V_2 (CS 18)	Mean	V_1 (CO CR-4)	V_2 (CS18)	Mean
T_{13}	0.27	0.22	0.25	0.47	0.40	0.44
T_{14}	0.30	0.25	0.28	0.54	0.48	0.51
T_{15}	0.33	0.29	0.31	0.61	0.53	0.57
T_{16}	0.21	0.17	0.19	0.38	0.32	0.35
Mean	0.31	0.23	0.27	0.57	0.47	0.52
	SED	CD (0.05)	-	SED	CD (0.05)	-
V	0.0005	0.001	-	0.001	0.002	-
T	0.001	0.003	-	0.003	0.007	-
VT	0.002	0.004	-	0.0053	0.010	-

Table 9: Effect of varieties and growth substances on herbage yield (g plant^{-1}) in coriander leaves at 45 DAS

Treatments	Herbage yield (g plant^{-1})			Estimated herbage yield (kg ha^{-1})			
	V_1 (CO CR-4)	V_2 (CS 18)	Mean	V_1 (CO CR-4)	Increases % over control	V_2 (CS 18)	Increases % over control
T_1	12.28	11.25	11.77	2942	07.2	2850	07.5
T_2	14.35	13.10	13.73	3184	15.9	3042	14.8
T_3	18.85	16.23	17.54	3500	27.5	3345	26.2
T_4	13.21	11.35	12.28	2932	06.8	2800	5.7
T_5	13.81	12.21	13.01	3085	12.4	2950	11.3
T_6	15.25	13.89	14.57	3304	20.4	3197	20.6
T_7	13.50	12.31	12.91	2996	09.1	2890	09.1
T_8	15.10	14.09	14.60	3247	18.3	3125	17.9
T_9	22.30	17.34	19.82	3751	36.6	3542	33.7
T_{10}	12.88	11.95	12.42	2958	07.8	2750	03.8
T_{11}	14.22	13.20	13.71	3156	14.9	3025	14.2
T_{12}	15.56	14.10	14.83	3313	20.7	3210	21.1
T_{13}	13.80	12.16	12.98	2962	07.9	2815	06.2
T_{14}	14.15	13.10	13.63	3140	14.4	3050	15.1
T_{15}	15.22	13.99	14.61	3378	23.1	3210	21.1
T_{16}	10.38	9.35	9.87	2745	-	2650	-
Mean	14.68	13.10	13.89				
	SED	CD (0.05)					
V	0.019	0.039					
T	0.056	0.112					
VT	0.079	0.158					

Variety (CO CR-4) +Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing recorded the highest yield (22.30 g plant^{-1} and 3751 kg ha^{-1}). The lowest yield per plant was recorded in CS 18+Control with 9.35 g plant^{-1} and 2650 kg ha^{-1} (Table 9). Favourable contributions of growth substances towards yield increase have been attributed to their influence on metabolic and cell division activities in the shoot apical meristem which could induce bud initiation leading to increased vegetative and reproductive branching[13, 14].

CONCLUSION

The study revealed that, the plants sprayed with Triacontanol 1 mL L^{-1} at 20, 30 and 40 days after sowing in the variety (CO CR-4) enhanced the growth characters like plant height, number of primary branches, number of leaves and physiological parameters like total chlorophyll content, leaf area, leaf area index, leaf area duration and fresh herbage yield (36.6% increase over the control).

ACKNOWLEDGEMENT

We acknowledged the Department of Spices and Plantation Crops, Tamil Nadu Agricultural University, Tamil Nadu, India for providing land and affording fiscal support for this study.

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